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year, as the conditions (harvest, seed-time ploughing, etc.) would vary considerably.

"(2) That the district from which the birds to be investigated come should be extensive but not too wide. If all were taken from a small area, local conditions would be too prominent; whereas, if birds were obtained from the whole of Great Britain, the variations in climate (and consequently in dates of seeding and harvest) would prevent a clear idea being obtained of the changes in the food materials that occurred from month to month.

"(3) That field notes ought to be taken when the birds were killed, the following facts being mentioned: (a) name and address of sender, (b) date and time of day, (c) exact locality in which the bird was killed, (d) weather, on account of its influence on insect life, (e) special notes, if the bird was doing any particular injury."

A distinct advance in method over previous work can be seen in the attempt to determine the food for the whole year by making collections of birds in the same general locality each month of the year. Although birds were collected where found feeding, attention is given the character of the place where the bird was collected, thus emphasizing the availability of certain kinds of food.

The food of the starling (*Sturnus vulgaris*) and of the lark (*Alauda arvensis*) is given in detail. The final verdict as to the economic value of the starling is as follows:

"(1) The starling is very beneficial during the late spring, summer and early autumn months, eating many harmful insects although a number of beneficial ones are also destroyed.

"(2) During the autumn, and to a less extent in the spring, much harm is done by the consumption of seed corn (particularly wheat); many harmful insects, however, are also destroyed during this period.

"(3) Owing to the fact of the bird's autumn and spring migrations, the remedies suggested are, either (i) to dress the seed corn with something that renders it distasteful to birds; or (ii), if suggestion (i) cannot be carried out successfully, to kill off the autumn migrants in large numbers."

The following conclusion is reached in regard to the lark: "On the whole the lark is beneficial; but, owing to the injuries done at certain times of the year, there is no reason why it should be specially protected, although its wholesale slaughter is to be deprecated."

A table showing the results of the stomach examination of various other birds, which were obtained in insufficient number "for an opinion to be expressed as to their utility," is added. A "List of References" gives a num-

ber of the important European publications on the food of birds.

In this paper there appear several original ways of tabulating results. One table gives the number of birds collected each month and the exact locality in which they were collected. A second table gives the date, time, place, locality, weather and sex, and tabulates the different kinds of food under the headings injuries, benefits, and neutral. A third tabulation groups seeds, vegetation, etc., insects, etc., and miscellaneous food under these same headings giving the "times occurred" and "number occurred." The material grouped in this way has been mounted on cardboard. To the student, but perhaps to a less extent to the farmer, this method presents vividly the economic aspect of each meal. As a method of preserving the material permanently, it has disadvantages as compared with the "vial" method.

A fourth table presents data from the standpoint of the food articles. It gives the percentage of times each article of food has been taken by the birds examined. A description of the food taken each month brings out clearly the change in food-habits from one part of the year to another and so emphasizes the necessity of a study of the bird's food the year through.

Perhaps the greatest criticism that can be offered is that against the use of the numerical method. To say that five out of twenty birds, or 25 per cent, ate carabid beetles hardly gives us a clear knowledge of the relation of this particular diet to the whole food or the bird's relative taste for carabid beetles. The percentage-by-bulk method used by the U. S. Biological Survey comes nearer showing the relative importance of the food elements. The value of the numerical method as a guide to the actual destruction accomplished, however, is self evident. A combination of both methods doubtless comes nearest the common aim—"interpretation of economic values."—H. C. BRYANT.

BIRDS IN RELATION TO A GRASSHOPPER OUTBREAK IN CALIFORNIA. By HAROLD C. BRYANT (Univ. Calif. Publ. Zool., xi, November 1, 1912, pp. 1-20).

In July, 1912, a plague of grasshoppers was reported from the vicinity of Los Banos, Merced County, California. The author visited the locality and spent a week there in studying the possible bearing of the native bird-life upon the insects. The present paper is occupied with an account of the observed facts, together with some general remarks upon the relation of birds to insect outbreaks.

It was found that at least fourteen species

of birds were feeding extensively upon grasshoppers. Taking into account numbers of individuals as well as destructive capacity of each species, the relative importance of the five ablest destroyers was as follows: (1) Bicolored Blackbird, (2) Western Meadowlark, (3) Killdeer, (4) Bullock Oriole, and (5) California Shrike.

It is shown that with abnormal increase of such an insect as the grasshopper, many birds appropriate this food source for the time being, and at once factor in checking the outbreak. The principle is emphasized that birds turn to the sort of food most readily available. While figures are given which show conclusively that the birds of the region could not have controlled the plague after once well under way, the author reasons by inference that many incipient insect outbreaks may be checked by birds at the outset, so that they never reach a point where great damage results. In the Los Banos outbreak, the insects had become so abundant locally that the birds when under observation made no noticeable headway against the pests from day to day; but it was possible to figure the value of the birds in hastening the end of the insect raid, and even in lessening the amount of aggregate damage sustained at the time.

Mr. Bryant's paper is commendable in its accurate detail of fact. More particularly is it admirable in the calm and judicious mode of drawing inductions. There is no discordant note of sentimentality to mar the paper as a scientific contribution.—J. GRINNELL.

A REVISION OF THE FORMS OF THE GREAT BLUE HERON (*ARDEA HERODIAS* LINNAEUS). By HARRY C. OBERHOLSER (Proc. U. S. Nat. Mus., vol. 43, December 12, 1912, pp. 531-559).

In this treatment of the Great Blue Heron ten geographical races are recognized, four of them being first described here. Descriptions, critical comments, and other details of the work are presented with all the painstaking care and accuracy characterizing previous contributions of the author, whose series of studies of various difficult groups forms such a valuable portion of the ornithological literature of recent years.

The paper under consideration is of especial interest to California ornithologists, in that two of the new subspecies described are from this state. *Ardea herodias hyperonca*, type locality Baird, California, is the name applied to the form inhabiting California in general, excepting the southeastern desert region and the Santa Barbara Islands. *Hyperonca* is distinguished from the Eastern *A. h. herodias* by its greater size alone, being exactly similar in color; as the much paler colored *treganzai* occupies the desert and Great

Basin regions intervening between the habitats of *hyperonca* and *herodias*, it is quite logical to recognize in nomenclature the differences between the two latter forms.

As much cannot be said of the island subspecies described. The characterization of *Ardea herodias oligista* is based upon a single immature bird from San Clemente Island, and such sweeping generalizations are made from the weak basis afforded by this one specimen that it almost appears that the author is giving expression to a preconceived belief that there *should* be a separate island subspecies, rather than to a dispassionate exposition of what his material actually reveals.

The only difference claimed for the island race is its smaller size. Coloration is declared to be the same as in the mainland form *hyperonca*. The one specimen available, though admittedly an immature bird, is said to be "evidently full grown". From the date of capture, August 26, this may, perhaps, be questioned. At any rate it is unfortunate that the only character ascribed to the race is one that might be explained by the immaturity of the single specimen examined. The subspecies described upon the strength of this one young bird from San Clemente Island is given a range including "Santa Cruz, San Nicolas, Anacapa, Santa Catalina, and probably other islands of the group", although certain of these islands have as little in common with one another as they have with the mainland.

We are also told that "this race is probably confined to the Santa Barbara Islands, as the species is said to be resident there". Just what grounds there are for the latter assertion is not apparent, and it is doubtful if the statement could be proved. The islands are such a short distance from the mainland that the intervening channels can be but inconsiderable barriers to a strong flying bird like the Great Blue Heron. In the present paper (page 536) we are told of a specimen of *A. h. herodias* taken at sea about 130 miles off the coast of New Jersey! Furthermore, a favorite feeding ground of the herons about the islands is on the extensive beds of floating kelp, which support the birds easily, and form convenient resting places at short intervals, should any such be required.

Altogether, even conceding the possibility of the existence of a race of *Ardea herodias* confined to the Santa Barbara Islands, we cannot admit it to be proved, nor even demonstrated to be reasonably probable, in the paper under discussion, while there are many facts that argue against it.

The description of the subspecies *oligista* seems ill considered, and is an undoubted blemish in what appears to be in other respects an excellent piece of work. It would